sport trainer SOLO

By STAN JOHNSON . . . A full house R/C trainer for .19 to .40 size engines. Unusual feature is the use of cardboard tubes for wing spars . . . easy to build, warp-proof, and very sturdy.

• The Solo is a sport trainer with the look of a full-size aircraft and many features that make it ideal for the student R/C pilot. It is lots of fun for the Sunday flyer too.

GENERAL CONSTRUCTION

You can use any 7/8 to 1-1/8 inch diameter cardboard tube with about 1/16 wall thickness for the spars. K&S piano wire tubes, 1 inch mailing tubes, or Solarfilm roll tubes will all work. Just be sure they are straight. You will need two tubes 24 inches long. The wing is built on jig blocks. The height of these blocks is determined by the diameter of the spar (1/2 inch tall for 1-1/8 inch diameter spar, 9/16 inch tall for 1 inch diameter spar, 5/8 inch tall for 7/8 inch diameter spar, etc.). Cut the jig blocks out of 1/4 inch or thicker sheet balsa to the height required for the size spar you use.

Sig Manufacturing's 1/8 inch "Lite Ply" is used for the one-piece fuselage sides. Lite ply is strong and light and eliminates the need for fuselage doublers in the nose.

The three-views of the cowl shown on the plans can be used as a guide to carve a mold to vacuform a cowl. You can also mold a cowl from fiberglas. The Solo flies fine without the cowl. It is not a mandatory item, but the model has much more eye appeal with one installed. If you don't care to fabricate one, a vacuformed cowl for the Solo is available from Solution Aeromodel Company, 6112 McKinney N.E., Albuquerque, New Mexico, 87109.

The basic structure of the Solo is strong and simple to build, but since the plane is intended for the novice, we will go through the building instructions step-by-step.

WING CONSTRUCTION

Glue 1/8 square balsa strips to the edges of the dihedral brace as shown on the plans. Draw a reference line on one end of one of the tube spars. Glue the 1/8 ply dihedral brace into this spar so that the brace coincides with the reference line. You will have to sand a radius on the 1/8 square balsa strips on the dihedral brace so that it will fit snugly in the tube spar. When the glue sets (use Titebond or equivalent), glue the other spar on the dihedral brace and set it on a flat surface to keep it straight and true. Be sure that the ends of the tube meet squarely at the joint.

Sand or plane a taper on the mating edges of the trailing edges as shown on the plans. Lay the plans on your workbench with wax paper or plastic film over the wing plan. Pin the trailing edge and jig blocks to the plans.

Place the center ribs on the plans and mark reference lines where indicated. (Note, the center rib is 3/16 balsa.)

Slide the 3/16 center rib, the 3/32 ribs numbered 1 and 2, and the eight 3/32 main ribs numbered 3, onto the spar marked with the dihedral brace reference line. Space them as shown on the wing plan.

Pin four or five main ribs to the trailing edge to align the main spar on the jig blocks. Now rotate the spar so that the dihedral brace reference line on the spar aligns with the reference line on the center ribs. This assures the proper dihedral. When all is aligned, pin the spar to the jig blocks.

Glue the ribs to the trailing edge. Glue on the 1/2 inch square leading edge. When the glue sets, add the top trailing edge piece. Check everything for alignment. Then glue the ribs to the tube spar (Use Titebond or equivalent). If the wing is straight when the ribs are glued to the spar, the wing will stay that way. The tube spar is very rigid and resists any tendency to warp. While the glue is setting on the wing panel, carve and sand the ailerons to the cross section shown on the plans.

When the right wing panel is dry, remove the wing structure from the plans. Reposition the jig blocks to the dotted lines. Turn the wing structure around on the plans to build the left wing panel. It is constructed in the same manner as the right panel.

When the glue dries, remove the wing structure from the plans. Cut the trailing edge and tube spar flush with the tip ribs. Notch the back side of the leading edge outboard of the last rib as shown on the plans. Glue the wing tips and gussetts in place. When dry, sand the wing tips flush with the trailing edge and glue on 3/16 balsa trailing edge braces.

Plank the top center section of the wing with 1/8 balsa. Cut notches on the bottom of three center ribs to install 1/8 x 1/2 x 3 inch plywood aileron servo mounts. Space them to fit your servo. Plank the bottom center section of the wing. When the glue is dry, cut away the bottom planking between the servo mounts to provide clearance for the aileron servo.

Cut the aileron horn bearing tubes to the length shown on the plans. Install tubes on the aileron horn wires. Bend the wire to the size and shape shown on the plans (Make one left and one right). Put a few drops of light oil in the bearing tube to keep the epoxy from gluing the horn wire to the bearing. Epoxy the spruce aileron horn mounts and the aileron horns to the trailing edge of the wing in the position shown on the plans. Make sure the threaded portion of the horns are on the bottom side of the wing.

Sand the entire wing smooth. Round the leading edge as shown, taper the trailing edge brace to match the aileron cross section, and round off the edges of the wing tips. Reinforce the center section with glass cloth and resin or glue. The wing is now ready to cover.

FUSELAGE AND TAIL SURFACES

Cut the center out of the fuselage former, using the template on the plans as a guide. Glue 1/4 square by 2-1/4 inch long balsa stiffeners to the former. Glue 1/4 square by 2-1/4 inch long balsa stiffeners to the bottom ends of the nose block. Viewed from the top looking forward, the nose block is 1/8 inch shorter on the right side than on the left. Leave a 3/8 inch space on either side of the stiffeners. Glue the horizontal and vertical stabs together. Pin them to a flat surface to keep them straight while the glue sets. After the glue sets, round off the leading edges of the tail surfaces and shape the control surfaces to the cross section shown on the plans.

Using spring clamp-type pins to hold them in place, glue 1/4 square balsa stringers to the left and right 1/8 inch lite ply fuselage halves. Note that the right fuselage half is 1/8 inch shorter than the left. This allows for proper engine offset when the firewall is installed. Glue on the wing saddle braces.

When the glue sets, clamp the fuselage sides back-to-back and sand to identical outlines. Align the fuselage sides from the tail end (Remember, the right fuselage half nose is 1/8 inch shorter than the left).

Mark the position of the former and landing gear mount on the fuselage sides (Again, the right side is shorter than the left). Glue the top nose block, former, and landing gear mount to the right fuselage half (Note that the short side of the nose block goes on the right fuselage half). Use a square or triangle to check that they are perpendicular to the fuselage sides.

Join the fuselage halves. Use masking tape and pins to hold them in place while the glue sets. Do not join the fuselage at the tail. Glue a 1/4 square by 2-1/4 inch long cross brace between the

fuselage halves at the bottom front corner. Check that everything is in alignment and set aside to dry.

Sand the top and bottom edges of the former flush with the fuselage side. Glue the 3/16 turtle deck to the top of the fuselage. Take care that the fuselage sides coincide with the turtle deck as it narrows towards the tail. Starting on either side of the 1/8 ply landing gear mount, plank the fuselage bottom with 1/8 balsa. The grain of the wood must run crosswise.

Using the appropriate template on the plans, mark and drill the firewall for the motor mount screws, fuel vent holes, and nyrod holes. Use a 9/64 drill for the motor mount and fuel vent holes, and a 3/16 drill for the nyrod holes. (Note: These templates are for Kraft Hayes motor mounts only). The fuel vents and nyrods are spaced for engines with the throttle arm on the right hand side, and the fuel line on the left. The nose gear steering is also on the right. If you mount your rudder servo on the left (see the radio installation instructions) and/or your engine's throttle arm is on the left, make your own template to suit your equipment. Glue the blind nuts for the motor mount on the back of the firewall. Sand the front of the fuselage so that the firewall mounting surface will be smooth and flat. Glue the firewall on, using masking tape to hold it in place while the glue sets.

Make the cut outs for the elevator and rudder pushrod exit holes in the places indicated on the plans. Round off the corners of the fuselage as shown, and sand the entire structure smooth. The fuselage is now completed.

If you like, you can reinforce the landing gear mount and firewall with two ounce glass cloth and a coat or two of resin.

COVERING AND FINAL ASSEMBLY

The Solo was designed with the modern mylar film coverings in mind. See the chart on the plans for a guide to the best utilization of the covering material. Cover the model according to the instructions provided with the plastic covering. Before you cover the wing, fin, and horizontal stab, make sure the ailerons, rudder, and elevator fit correctly. Don't forget to allow for the hinge gap between the control surfaces. Drill a 3/32 hole and cut the slot in the ailerons for the aileron horns before you cover them. Cover all the components of the model before final assembly. Trim model to suit your taste. Patterns for windshield and cabin windows are included on plans. Make them from Monokote trim sheet or equivalent.

Cut the hinge slots where indicated on the plans and install the control surfaces with molded plastic hinges. Use Titebond or epoxy to glue hinges in slots. Glue the horizontal and vertical stabilizers on. Cut away covering materials from the surfaces to be glued. Check for proper alignment before the glue sets. Glue in the wing hold-down dowels and install the 1/8 wing seating tape in the wing saddle. Bolt on the control horns for the rudder and elevator.

To install the main gear, mount the landing gear wires on the fuselage first. Now bring the two wires together, wrap, and solder them as shown on the plans. Attach the main wheels (DuBro wheel collars work well). You will have to drill out two of the 1/8 inch nylon landing gear clips to fit the 5/32 wire. Clamp or bolt them to something flat and hard. Then run a 5/32 drill clips to the fuselage. Drill No. 60 pilot holes for screws. The wide stance of the main gear will keep you from skinning the wing tips and doing ground loops on not-so-good landings.

Place your Kraft-Hayes mount over the appropriate template on the plans and mark it to drill a No. 30 hole for the 1/8 nose gear strut. Install the nose gear strut, steering arm, and wheel on the engine mount. Bolt the engine mount to the firewall. Use 4-40 bolts with lock washers and flat washers. Bolt the engine to the mount. Install the nyrod housings in the firewall. Use epoxy to hold the housings in place.

To install the tank, bend the fuel lines coming from the tank as shown in the photograph. Slip three wire rods through the fuel vent line holes from the front side of the firewall. Slip the tank vents over these rods inside the fuselage and push the entire assembly forward into place. The wire rods will guide the tank vents through the holes in the firewall. Use foam rubber to hold the tank in place. Seal the holes in the firewall around the tank vents with epoxy or silicon rubber.

Nyrod pushrods are used for the throttle and nose gear steering. Quarter inch square balsa, threaded rods, and 1/16 music wire are used to make the pushrods for the rudder and elevator. The threaded rods go on the control surface end of the 1/4 square balsa pushrods. The 1/16 music wire is used on the servo end. Snap Klevises and nyrod studs are used to attach the nyrod pushrods to the servos and engine, etc. Snap-r-Keepers are used to attach the elevator and rudder push rods to the servos. Snap Klevises are used on the control surface end. When you make up the pushrods and nyrods, leave the ends that are attached to the servos extra long. You will not be able to cut them to the exact length until you have established the correct radio location in the model.

RADIO INSTALLATION

Read the installation instructions that come with your radio first. Then . . .

The radio components are used to obtain the correct center of gravity (C.G.) position on the model. This is done by moving the radio components back and forth in the radio compartment until the model balances correctly. To do this, the model must be completely assembled with all items such as the engine, muffler, spinner, prop, wheels, installed. In other words, the model should be completely finished with the exception of the radio installation.

Install the aileron servo and linkage in the wing. Use short 1/16 diameter threaded rods for the aileron push rods. Place the radio components in the fuselage and put the wing on the model. Suspend the model from the C.G. (A loop of string under the wing hold-down rubber bands works well.) If the plane hangs nose down, move the radio components towards the rear of the model. If it hangs nose high, move the radio components forward.

When the model balances correctly, mark the position of the components in the fuselage. Glue in the servo tray mounting rails. Space them to fit your equipment. Mount the servos as low as possible in the fuselage so they won't interfere with the aileron servo and linkage. (A Two-Plus-One servo tray works best. Arrange servos as shown in photo). Cut the nyrod and pushrod ends to fit the servo location. Hook everything up and check for smooth operation. If anything binds, find out why and correct it. Set up your controls for no more than 15^{0} movement either side of neutral on any of the control surfaces. Optimum control surface travel for your airplane and style of flying must be determined by experiment during test flying.

FLYING

If you are a beginner, enlist the help of an experienced R/C pilot to help you test fly and trim your Solo. Ask him for help in flight training too.

The Solo makes a good basic trainer with a 20-30 engine and minimal control surface travel. With a 30-40 engine and increased control travel, it's an excellent aerobatic trainer.

For those of you who like the Solo, but do not like to scratch-build from plans, a Solo kit will be available from Solution Aeromodel Co., 6112 McKinney N.E., Albuquerque, New Mexico, 87109.